

THE INVENTION CLAIMED IS

1. A system for generating a powerful laser beam, comprising:
  - a laser element array including a first laser element and at least one additional laser element, said first laser element and said least one additional laser element having a rear laser mirror, an output mirror, and semiconductor laser material between said rear laser mirror and said output mirror;
  - an injector for directing a first part of an injection laser signal into said first laser element and for directing at least one additional part of the injection laser signal into said at least one additional laser element;
  - said laser element array transforming said first part of the injection laser signal and said at least one additional injection laser signal into a first circulating laser beam in said first laser element and at least one additional circulating laser beam in said at least one additional laser element;
  - a reference laser beam source for directing a first part of a reference laser beam into said first laser element to mix with said first circulating laser beam and for directing at least one additional part of a reference laser beam into said at least one additional laser element to mix with said at least one additional circulating laser beam;
  - an amplifier and phase conjugater for amplifying and phase conjugating said first part of a reference laser beam and said at least one additional part of a reference laser beam and producing a first amplified output laser beam emanating from said first laser element and at least one additional amplified output laser beam emanating from said at least one additional laser element; and
  - a combiner for combining said first amplified output laser beam and said at least one additional amplified output laser beam into the powerful laser beam.

2. The system for generating a powerful laser beam of claim 1, wherein said output mirror is 100% reflective at normal incidence and <5% reflective at an input beam angle.

3. The system for generating a powerful laser beam of claim 2, wherein said input beam angle is between 20° and 70°.

4. The system for generating a powerful laser beam of claim 3, wherein said input beam angle is Brewster's angle for the incoming part of the reference beam.

5. A system for generating a powerful laser beam, comprising:

laser element means comprising a first laser element and a second laser element, said first laser element and said second laser element having a rear laser mirror, an output mirror, and semiconductor laser material between said rear laser mirror and said output mirror;

initiating means for directing a first part of the injection laser signal into said first laser element producing a first circulating laser beam, and for directing a second part of the injection laser signal into said second laser element producing a second circulating laser beam;

input means for directing a first part of a reference laser beam into said first laser element to mix with said first circulating laser beam, and for directing a second part of a reference laser beam into said second laser element to mix with said second circulating laser beam;

amplification and phase conjugation means for amplifying and phase conjugating said first part of a reference laser beam to produce a first amplified output laser beam from said first laser element, and a second amplified output laser beam from said at least one additional laser element, and

combiner means for combining said first amplified output laser beam and said second amplified output laser beam into the powerful laser beam.

6. The system for generating a powerful laser beam of claim 5, wherein said output mirror is 100% reflective at normal incidence and >5% reflective at an input beam angle.

7. The system for generating a powerful laser beam of claim 6, wherein said input beam angle is between 20° and 70°.

8. The system for generating a powerful laser beam of claim 7, wherein said input beam angle is Brewster's angle for the incoming part of the reference beam.

9. A method of generating a powerful laser beam, comprising the steps of:  
providing a first laser element having a rear laser mirror, an output mirror, and semiconductor laser material between said rear laser mirror and said output mirror,

providing at least one additional laser element having a rear laser mirror, an output mirror, and semiconductor laser material between said rear laser mirror and said output mirror,

injecting a first part of the injection laser signal into said first laser element,

injecting at least one additional part of the injection laser signal into said at least one additional laser element,

injecting a first part of a reference laser beam into said first laser element,  
injecting at least one additional part of a reference laser beam into said at least one additional laser element,

amplifying and phase conjugating said first part of a reference laser beam and said at least one additional part of a reference laser beam thereby producing

a first amplified output laser beam emanating from said first laser element and an additional amplified output laser beam emanating from said at least one additional laser element, and

combining said first amplified output laser beam and said additional amplified output laser beams into the powerful laser beam.

10. The system for generating a powerful laser beam of claim 9, wherein said step of injecting a first injection laser signal into said first laser element is injected at an input beam angle between 20° and 70°.

11. The system for generating a powerful laser beam of claim 9, wherein said step of injecting a first injection laser signal into said first laser element is injected at an input beam angle equal to Brewster's angle for the incoming part of the reference beam.